Non-hospital-associated methicillin-resistant *Staphylococcus aureus* and MRSA chronic carrier patients in infection control

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This study reports research on methicillin-resistant *Staphylococcus aureus* (MRSA) colonized-infected patients who were admitted to a 320-bed hospital. Specifically, we report on the difficulties related to MRSA infection control as a consequence of the increasing incidence of non-hospital-associated MRSA acquisition and patients as chronic carriers who are frequently readmitted to the hospital.

Key Words: Methicillin-resistant *Staphylococcus aureus*; epidemiology; nosocomial infections; community-acquired infections; infection control.

Health care-associated methicillin-resistant *Staphylococcus aureus* (HCA-MRSA) infections are increasing, and a new type of (MRSA) is emerging as a significant pathogen in the community, with a different epidemiology, microbiology, and clinical appearance to hospital-associated infections (HA-MRSA). Community-associated (CA-MRSA) is endemic in the United States, and recent articles have detailed its transmission within hospitals, establishing a new nosocomial risk.[1] The increase in MRSA infections, as well as in chronic carriers who commute indistinctively between hospitals and community environments, can complicate their identification.[2] We present descriptive research with the following aims: (1) to identify non-HA-MRSA clinical and epidemiologic features and (2) to establish the importance of chronic MRSA carriers in infection control.

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METHODS AND MATERIALS

We performed a descriptive study of all the MRSA infected/colonized patients admitted to a 320-bed hospital in northwest Spain between 1991 and 2008. The identification of MRSA strains and antimicrobial resistances was performed following Clinical and Laboratory Standards Institute (CLSI) guidelines.[3] According to the 1991 protocol, data gathered from each patient and hospital admission were categorized as follows: name, address, date of admission, clinical findings, severity of underlying diseases (McCabe classification), use of antibiotics or instrumentation within previous 12 months, room, date, and samples of MRSA positive culture, site of acquisition, resistance pattern, treatment, and evolution. Information was obtained through personal interviews with patients, clinical history reviews, computer records of hospital admissions, and transfer medical records from other hospitals.

The presence and type of MRSA infection were assessed according to the Centers for Disease Control and Prevention (CDC) criteria.[4] MRSA acquisition was classified epidemiologically as follows: (1) HA if isolated >48 hours after admission; (2) HA imported if isolated <48 hours after admission of a patient who had been transferred from another hospital or health center; (3) HCA-MRSA if during the previous year any of the following applied: admission for >2 days to hospital; nursing homes; specialized home care units; or day-hospitals and undergoing surgery, dialysis, or permanent indwelling catheters; (4) CA-MRSA if isolated in an outpatient or within 48 hours after admission and

none of the above circumstances applied. New patients were those without evidence of previous MRSA positive cultures in their clinical record and those transferred from other medical centers and admitted to our hospital for the first time. Patients whose previous cultures were positive for MRSA in our hospital before admission were considered as chronic carriers.

Prevention and control programs included isolation and barrier precautions, decolonization of MRSA carriers and treatment, and weekly screening cultures during their hospital stay and in case of readmission. A screening study was undertaken on those sharing a room with new isolation MRSA patients. Those with a positive result were considered as new cases.

Nosocomial rates were calculated as the number of new MRSA cases per 1,000 inpatient-days. A descriptive and comparative analysis was conducted using the χ^2 or Fisher exact test for categorical variables and Student t or the Mann-Whitney U test for continuous variables, with $P < .05$ considered significant.

RESULTS

A total 276 hospital admissions was recorded in 260 patients. Of the 260 patients, 194 (74.6%; 95% confidence interval [CI]: 69.3-79.9) were considered as new cases (28 were detected by screening in 133 roommates), and incidence increased along the time until reaching 0.31 per 1,000 hospital stays in 2008. MRSA acquisition was considered to be non-HA in 53 cases (27.3%; 95% CI: 21-33.6), CA-MRSA in 18 patients (9.3%; 95% CI: 5.2-13.4), and HCA-MRSA in 35 cases (18%; 95% CI: 12.6-23.4). In 109 cases (56.2%; 95% CI: 49.2-63.2), acquisition was HA and in 32 (16.5%; 95% CI: 11.3-21.7) HA imported. Figure 1 shows the evolution of MRSA acquisition. During the last 4 years, the incidence of non-HA-MRSA has increased: 69.8% of the cases (HCA-MRSA 62.9%; CA-MRSA 83.3%) appeared in this period, $P = .009$.

One hundred thirty-three patients (68.5%; 95% CI: 62-75) showed MRSA infection, and 61 patients were MRSA colonized. Table 1 shows the characteristics of those infected patients.

By comparing HCA-MRSA cases to those HA-MRSA patients, the former showed a higher frequency of rapidly fatal chronic underlying disease and skin/soft tissue infection, $P < .05$. A total of 20 patients died of MRSA infection, and, for 16 of them, empiric treatment was not correct.

When considering HA-MRSA and HCA-MRSA cases as a single group and comparing them to CA-MRSA patients, the latter showed a lower average age, scarcer use of antibiotics within the previous 12 months, ciprofloxacin resistance ($P < .05$), and a higher frequency of tetracycline resistance (40% vs 10.4%, respectively). Two patients reported contact at home with a MRSA carrier.

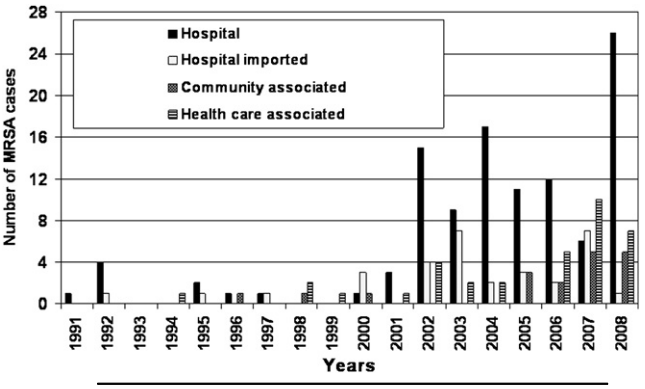

Fig 1. Evolution on the acquisition site of new MRSA cases.

Eighty-two hospital admissions accounted for 66 MRSA chronic carrier patients. Admissions increased with time, and 58.8% of them appeared in the last 2 years, $P < .05$. A previous decolonization had been performed in at least 19 patients; nevertheless, colonization persisted in 68.4% of them. Carrier condition lasted for 10.2 ± 14.8 months (range, 7 days to 5.6 years).

DISCUSSION

Both MRSA incidence and HCA-MRSA proportion showed in our series are lower than those found in Spain in 2003 (HCA-MRSA, 38%). The development of CA-MRSA in Spain is not well-known. It was lower than 1% in 2003, and, since then, some isolated cases have been reported.[5] The method used to gather information and the continuation of the same prevention and control programs over time lead us to believe that we have solid epidemiologic criteria to affirm that our results show the increasing importance of CA-MRSA and HCA-MRSA. Our study is focused on inpatients. Non-HA-MRSA frequency might have been underestimated because more cases may have been diagnosed and treated as outpatients. Another limitation of our work is the absence of a molecular study of the strains; however, some studies showed that those strains considered to be either hospital or community associated can now coexist in both places.[1,6]

HCA-MRSA features are similar to those of HA-MRSA. The possibility of MRSA infection for those elderly patients who present comorbidity, previous use of the antibiotics, admittance to hospital during the last year, and skin/soft tissue infection should be considered to carry out a screening culture and to implement a